**Evaluating Economic Effects of the 2004 Tsunami on International Trade**

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In order to enhance economic resilience to the natural disasters, it is important to project and analyze the economic impacts of past events in a comprehensive perspective. Fewer studies exist regarding the disaster's impact on international trade. This study will fill the gap by estimating the higher-order effect of the Tsunami, specifically in terms of international trade on the basis of the damage/loss information from various sources and of the previous modeling studies (Okuyama, 2010).

This study aims to estimate the regional and global regional economic impacts of the 2004 Indian Ocean Tsunami within the GTAP (Global Trade Analysis Project) Global Computable General Equilibrium (CGE) model (https://www.gtap.agecon.purdue.edu/models/current.asp). The global CGE framework is selected to represent the relationship among the Tsunami affected countries (Indonesia, India, Sri Lanka, Maldives, and Thailand) and their major partners (Japan and US) in details.

In addition to economic impact assessment at the sectoral/national/multi-national levels, the multi-country the GTAP-CGE framework for the Tsunami affected countries will also be used for policy recommendations. The simulation analyzes the case where the major economic partners of the Tsunami affected countries (US and Japan) commit to post-disaster international aid for recovery. The CGE model will be used to keep track of the feedback mechanisms between the international donor countries and Tsunami affected economies. Assuming that the aid helps the Tsunami affected countries to quickly rebuild the traditional trade links with US and Japan, the CGE model will be used to determine the optimal level of aid which would allow the donor countries to compensate for their economic losses from disrupted commercial links. Based on these results, further scenarios will be developed.

The CGE analysis will be conducted in a comparative static framework. The GTAP model is calibrated on 2004 data and includes 57 sectors. A detailed sensitivity analysis will complement the scenario analysis.

**Macroeconomic analysis using the Computable General Equilibrium (CGE) Model**

The tool used for this analysis is a Computable General Equilibrium (CGE) Model. The model incorporates links between the 57 sectors of the Indian economy as well as links between the economic output of these sectors and emissions of pollution. The analysis will make no attempt to provide a comprehensive evaluation of every environmental problem confronting India. Instead, subject to data availability, the focus will be on environmental impacts that are known to have large developmental costs. It focuses on two key issues – particulate emissions (PM10) and inadequate water supply & sanitation (WSS). It also allows for the fact that, when PM10 emissions are high and when WSS is inadequate, labor productivity is reduced and with it the level of GDP. The analysis considers three scenarios:

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## ANNEX

## List of 57 sectors included in the GTAP-CGE Model

**Agriculture related**

Paddy or rice; wheat; cereal grains and others; vegetables, fruit, nuts; oil seeds; sugar cane, sugar beet; plant-based fibers; crops and others; bovine cattle, sheep and goats; animal products and others; raw milk; wool, silk-worm cocoons; forestry; fishing.

**Energy related**

Coal Mining, Crude oil, Natural gas extraction, Refined oil products, petroleum, coal products and Electricity

**Energy intensive industries**

Minerals and others; chemical, rubber, plastic prod; mineral products and others; ferrous metals; metals and others.

**Other industries and services**

Bovine cattle, sheep and goat ; meat products; vegetable oils and fats; dairy products; processed rice; sugar; food products and others and others; beverages and tobacco products; textiles; wearing apparel; leather products; wood products; paper products, publishing; metal products; motor vehicles and parts; transport equipment and others; electronic equipment; machinery and equipment and others; manufactures and others; water; construction; manufacturing and distribution of natural gas; trade; transport and others; water transport; air transport; communication; financial services and others; insurance; business services and others; recreational and other service; public administration and defence, education; ownership of dwellings.

## CGE Model Production Structure

 Output

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 / \ <----- CES

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 Value Added Intermediate Consumption

 (5 energy, 52 non energy goods)

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 CES -----> / | \ / \ <------ CES

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 Land Labor Capital Domestic Foreign